GINEER RESEARCH & DEVELOPMENT CENTER
Topographic Engineering Center
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ARMY EVALUATION OF SHUTTLE RADAR TOPOGRAPHY MISSION DIGITAL TERRAIN ELEVATION DATA, LEVEL 2 (SRTM DTED 2)

Background

- 1997 DARPA/TEC study validates mathematical accuracy of radar collected digital elevation data but identifies “different properties” and anomalies (void areas/contour interpretation) vs. photogrammetric source materials.

  - Report recommends further study to determine if functional use of the two products will yield similar performance during operational or training use.

- February 2000: SRTM elevation data collected over 80% of the Earth’s surface at 30 meter resolution (designated SRTM DTED 2 to distinguish it from photogrammetrically derived DTED2).

- SRTM DTED 2 anticipated to eventually comprise the bulk of the National Geospatial Intelligence Agency’s (NGA) elevation data holdings and become a critical “backbone” mapping tool for the future.

- In response, Army prepared a proposal to conduct a ground-truth validation of SRTM DTED 2 data to determine operational effectiveness.

Issues

- Importance of data fidelity & real-world representation is well-documented.
- Current army combat models/systems rely heavily on elevation data to conduct analyses and are very sensitive to source data variations.
- Army's Future Combat Systems are expected to use SRTM DTED 2 as their primary source of digital elevation data.
- NGA will address some but not all of SRTM DTED 2 collection anomalies (large spikes & wells; very small voids; water normalization)
- A clear understanding of SRTM DTED 2 fidelity and capabilities at this early stage is crucial to insure continued technology improvement.
- Failure to understand the inherent capabilities and limitations of the data in terms of real-world applications will result in inappropriate use & potential erroneous results in M&S/C4I activities

Status

- Proven methodology to evaluate data established.

  - compare to traditional DEMS/TINS
  - void area and terrain profile/contour analyses
  - ground truth LOS & slope data, varying algorithms, and terrain representations used to determine sensitivity of SRTM DTED 2 for specific M&S/C4I systems

- SRTM DTED 2 “finished” data is currently being received at NGA & placed on their data distribution gateway

- Increasing proliferation of data has led to recognition that a technical evaluation of SRTM DTED 2 capabilities/utility is vital to the

Study Activities to Date

- Technical Fact Finding Completed at NGA Maintenance Site
- SRTM DTED 2 “Finished” Data Acquired Over 6 Study Areas (Bare Earth, Semi-Vegetated, Vegetated) and some Initial Analyses Completed
- Point Paper Prepared to Identify Preliminary Data Advantages/Shortfalls and Outstanding Issues
- Ground Truth Data Validation Activities Scheduled (Mar ’04) at “Bare Earth” Test Site (Yuma Proving Ground, AZ); Semi-Vegetated & Vegetated Areas Field Data Collection to Follow Throughout FY 04/05.

Advantages

- **Increased Coverage –** SRTM DTED 2 will provide extensive elevation coverage between 60 degrees N and 60 degrees S latitude (approximately 14,200 one degree cells) including perpetually cloud-covered areas along the equator and in other locations where elevation data had previously been unavailable.

- **Improved Terrain Visualization (except in smooth terrain areas)** – SRTM DTED 2 can be used in conjunction with CIB to provide better visualization of the terrain and its impact on military operations.

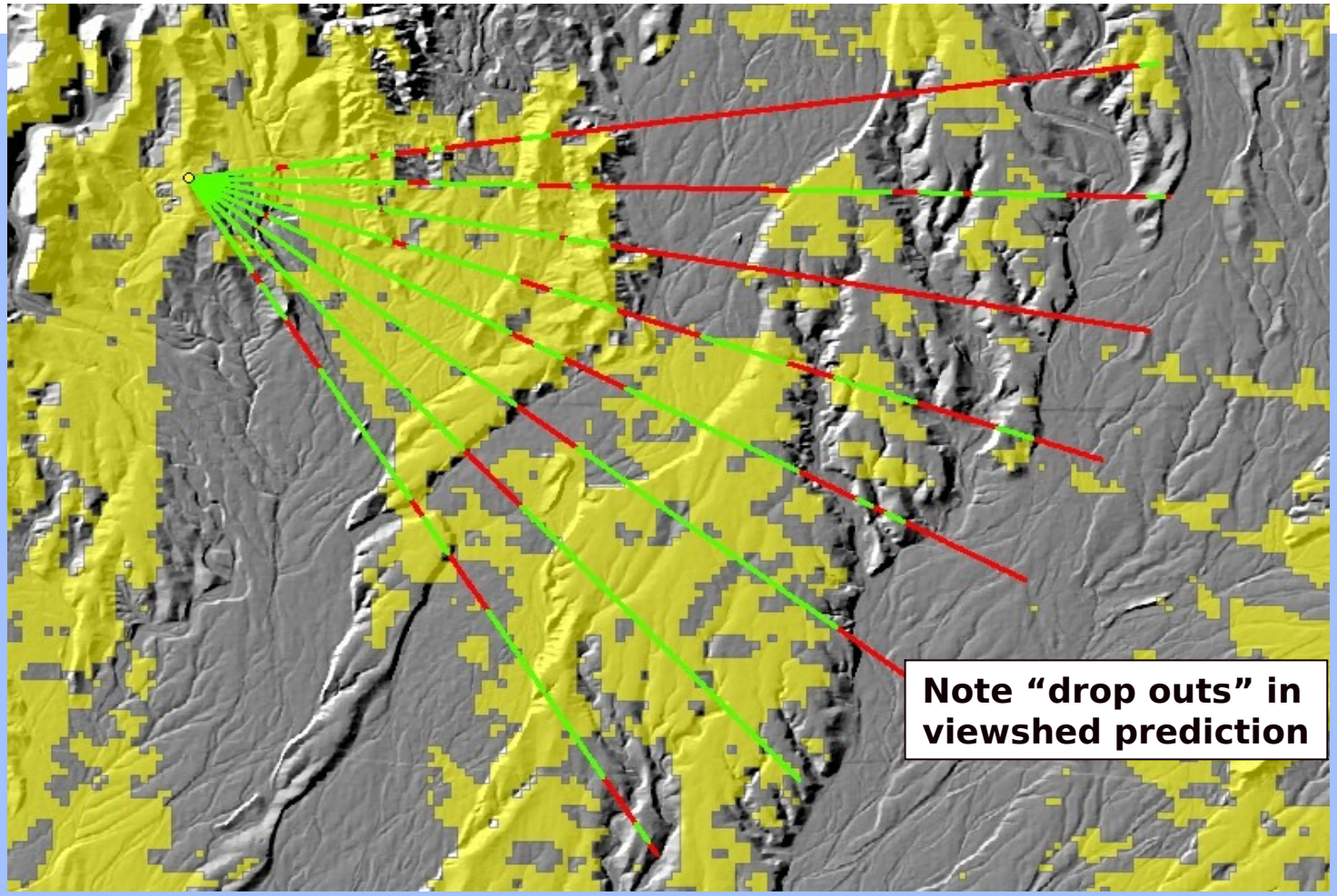
- **Better Support to Orthophoto Rectification** – NGA/St. Louis is currently using SRTM DTED 2 data to orthorectify Controlled Image Base (CIB) 1 & 5 on a routine basis with excellent results.

Shortfalls

- **Unusable Contours in Smooth Terrain –** Map contour lines generated in smooth terrain are unusable due to random SRTM DTED 2 data noise that remains after final data processing.
- **Negative Impact on Line of Sight (LOS) Prediction Accuracy & Ability to Visualize Smooth Terrain Areas –** The noise-induced anomalies create erroneous results in LOS and related visualization applications in smooth terrain areas especially at the low grazing angles required for most Army operations.
- **Presence of Void Areas -** Void data areas could have a significant impact on the accuracy of Army applications.

  Larger void areas (over 16 posts) will only be filled by NGA on a "customer request" basis.

  ~175 cells (>1% of global coverage) are expected to have over 20% void areas rendering them as virtually unusable.



Yuma Site1 (3.6 KM x 4.4 KM)
Viewshed from Shuttle Radar Topography Mission (SRTM

Next Steps…

- Army will complete comprehensive DA-funded evaluation to determine operational effectiveness of SRTM DTED 2 during FY04/05

In the meantime:

- NGA will evaluate the feasibility of noise reduction algorithms (in the post finishing phase) and/or COTS tools to improve the utility of the SRTM DTED 2 data for use in LOS, visualization and related critical Army positioning and navigation applications
- Army components of Combatant Commands should urge NGA to adopt a more comprehensive approach to the void-fill process including:

  1) automatic filling of all voids over 16 posts in size (not just by customer request) and;

  2) complete photo source re-collect of all SRTM DTED 2 cells deemed “unusable” based on the 20% void criteria.

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